Artificial Pupil, consisting of an anterior membranous and a posterior muscular coat; the latter, in the act of contraction, presses back the lens upon the vitreous humour, the elasticity of which causes it again to advance when the sphincter muscle of the iris relaxes. In proof of the correctness of this opinion, Sir Everard adduces some experiments illustrative of the influence of belladonna upon myopic eyes.

Having ascertained that the marsupium is not muscular, I could only consider it, says the author, as a screen preventing the pencils of rays that fall upon the portion of the retina within the axis of the optic nerve, from extending to the outer portion. And after explaining to Mr. Dollond, that the situation of the bird's eye in the head makes the image of a distant object fall upon the retina within the axis of the optic nerve, and of a near one without that axis, as the bird only sees the object with one eye at a time; but the human eye, and that of quadrupeds, will have the image of a distant object fall on the retina, without that axis, both eyes being turned to the object;—he said that the inner portion of the bottom of the bird's eye was more extensive than the outer, and made a portion of a larger curve; consequently, was at a greater distance from the lens, and therefore adapted to longer pencils of rays fitting it for distant vision; while the outer portion being nearer, the lens was fitted for seeing near objects, the marsupium confining the rays, and preventing the vision from being confused.

In the human species and quadrupeds, the bottom of the eye has one uniform curve, the portion within the axis of the nerve being smaller than the outer, which is the very reverse of what it is found to be in birds, adapting both eyes to see the same distant object at one time.

A Letter from John Pond, *Esq. Astronomer Royal, to Sir* Humphry Davy, *Bart. President of the Royal Society, relative to a Derangement in the Mural Circle at the Royal Observatory.* Read November 22, 1821. [*Phil. Trans.* 1822, *p.* 86.]

On the Finite Extent of the Atmosphere. By William Hyde Wollaston, *M.D. V.P.R.S.* Read January 17, 1822. [*Phil. Trans.* 1822, *p.* 89.]

It has been inferred from measuring the barometrical pressure at different elevations, that the earth's atmosphere extends to the height of 40 miles, beyond which limit we are left to conjectures, founded on the supposed divisibility of matter; which, if infinite, indicates an infinity of atmosphere. If, however, it consist of ultimate indivisible particles, then expansion of the medium composed of them must cease at that point where the force of gravity downwards, upon a single particle, is equal to the resistance arising from the repulsive force of the medium. If we adopt the latter hypothesis, no part of our atmosphere could ever leave the earth; if the former, every pla-

netary body must possess its respective share, provided we rest our reasoning upon the known properties of matter. The author, therefore, thought it deserving of consideration, whether, in any instance, any deficiency of atmosphere could be proved, and whether, from such source, any conclusive argument could be drawn in favour of ultimate atoms of matter in general; for since the chemical law of definite proportions applies to all forms of matter, if it can be proved that any one body consists of particles no longer divisible, we then can scarcely doubt that all others are similarly constituted. In respect to the non-existence of an atmosphere round the moon, Dr. Wollaston observes, that the quantity of such matter retainable by a body of the moon's magnitude, could not give rise to any phenomena observable by our instruments; that we should therefore look for information in an opposite direction, and examine that body which has the greatest power; if we there find no appearance of an atmosphere, we may infer that our own is peculiar to the earth. In respect to the sun, for instance, if we calculate at what apparent distance from his body his force is equal to that of gravity at the surface of the earth, it is there that his power would be sufficient to accumulate, from an infinitely divisible medium filling all space, an atmosphere fully equal in density to our own, and therefore producing a refraction of more than 1° in the passage of rays obliquely through it.

Dr. Wollaston then proceeds to show, from a detail of observations of the passage of Venus near the sun in superior conjunction, which took place in May last, that no such retardation in the motion of that planet could be perceived in her progress toward the sun, as would occur from increasing refraction, and that the phenomenon does not offer the least evidence of the existence of a solar atmosphere.

After some suggestions respecting the best means of pursuing this investigation, Dr. Wollaston observes, that he has dwelt perhaps more upon the consideration of a solar atmosphere than may seem necessary to those who will consider the phenomena of the occultations of Jupiter's satellites by the body of the planet, the approach of which is regular, till they appear in contact, instead of being retarded by the refraction arising from an atmosphere so extensive as Jupiter should attract to himself, from an infinitely divisible medium filling space.

Since the mass of Jupiter is 309 times that of the earth, the distance at which his attraction is equal to gravity must be about 17·6 times the earth's radius; and since his diameter is nearly 11 times greater than that of the earth, 1·6 time his own radius will be the distance from his centre at which an atmosphere equal to our own should occasion a refraction exceeding 1°. To the fourth satellite this distance would subtend an angle of about 3° 37′; so that an increase of density to 3·5 times that of our common atmosphere would be more than sufficient to render the fourth satellite visible when behind the centre of the planet, and consequently to make it appear on all sides at

the same time. The space of about six miles in depth, within which this increase of density could take place according to known laws of barometric pressure, would not subtend to our eye so much as $\frac{1}{300}$th of a second, a quantity not to be regarded in an estimate where so much latitude has been allowed for errors.

In concluding this paper, Dr. Wollaston remarks, that although in reference to a solar atmosphere some doubt may be entertained in consequence of peculiar effects of heat, no such error can be suspected in regard to Jupiter; and as that planet has not its due share of an infinitely divisible atmosphere, there seems no ground upon which the phenomenon of the earth's atmosphere can be maintained, but on the supposition of ultimate atoms of definite magnitude, no longer divisible by repulsion of their parts.

On the Expansion in a Series of the Attraction of a Spheroid. By James Ivory, *M.A. F.R.S.* Read January 17, 1822. [*Phil. Trans.* 1822, *p.* 99.]

Mr. Ivory's principal object in this paper appears to be the removal of some difficulties in the demonstration of the method of developing the attractions of spheroids in an infinite series, as employed by Laplace in the *Mécanique Céleste*. It is natural to think, he observes, that the theory of the figure of the planets would be placed on a firmer basis if it were deduced directly from the general principles of the case, than when it is made to depend on a nice and somewhat uncertain point of analysis; and he conjectures that the theory will probably be found to hinge on this proposition,—that a spheroid, whether homogeneous or heterogeneous, cannot be in equilibrium by means of a rotatory motion about an axis, and the joint effect of the attraction of its own particles and of the other bodies of the system, unless its radius be a function of three rectangular coordinates; for if this proposition were clearly and rigorously demonstrated, the analysis of Laplace, on changing the ground on which it is built, would require little or no alteration in other respects.

Without, however, attempting to demonstrate this proposition in all its extent, the author has substituted a more direct and simple mode of argument than that of Laplace, which is perfectly conclusive with respect to all the cases to which the theorem in question can possibly require to be applied. He has shown that by immediately transforming a given expression into a function of three rectangular coordinates, we obtain the same development as is deduced in the *Mécanique Céleste*, by a more general and complicated mode of reasoning, which seems to be so far objectionable, as it tends to introduce a variety of quantities into the series which do not alter its total value, since they destroy each other, but which may possibly interfere with the accuracy of its application to particular cases, in which it may be employed as a symbolical representation: for example, when any finite number of terms is assumed as affording an approximate value;